merly a wider range than now, and that they are gradually disappearing. The physiography of the coast of Acadia was then discussed, the distribution of currents considered, and evidence given to show that the land in all this region is steadily sinking. The effect of this depression on the currents of this coast was discussed, and the views of Verrill and Dawson considered. The conclusion was arrived at, that the known facts as to currents, the sinking of the land, etc., explained the phenomena under discussion. The relation of these facts to post-pliocene conditions was referred to, and a sketch given of what remains to be done in this field.

At the closing meeting of the society, the following officers were elected for the ensuing year in the Geological Section: viz., president, Professor W. Saunders, director of the Central Experimental Farms, etc.; vice-president, Professor L'Abbé Laflamme; secretary, Mr. J. F. Whiteaves. For the whole society, Very Rev. Principal George Munro Grant of Queen's University, Kingston, was elected president, and Rev. L'Abbé Laflamme of Laval University, vice-president. The honorary secretary is Dr. J. E. Bourinot.

HEALTH MATTERS.

Sterilizing Water.

IN a paper published in the *Medical Record* of June 14, 1890, Dr. C. G. Currier of New York states that unless extraordinarily resistant, water becomes sterilized if it be at or near the boiling temperature for fifteen minutes. If the same degree of heat be maintained for five minutes, all harmful micro-organisms will have been destroyed. Still less time serves to destroy the disease-producing varieties which are recognized as liable to occur in water. Thus merely raising to the boiling-point a clear water containing the micro-organisms of malarial disorders, typhoid, cholera, diphtheria, or of suppurative processes, and allowing it to gradually cool, insures the destruction of these germs. They are also destroyed by keeping the water for from a quarter of an hour to half an hour at a temperature of 70° C.

Occasionally, however, very resistant but harmless bacteria may get into water. The brief heating renders them safe for drinking-purposes; but, when it is desired to destroy every micro-organism that may be present in a contaminated water, it should be heated for one hour, and allowed to cool slowly. Then it may be used for cleansing wounds or for alkaloidal solutions, which will keep indefinitely if no germs be introduced after the solution has been heated.

Coffee Inebriety.

Dr. Mendel of Berlin has lately published a clinical study of this neurosis, his observations being made upon the women of the working population in and about Essen. He found large numbers of women who consumed over a pound of coffee in a week; and some men drank considerably more, besides beer and wine. The leading symptoms were profound depression of spirits, and frequent headaches, with insomnia. A strong dose of coffee would relieve this for a time, then it would return. The muscles would become weak and trembling, and the hands would tremble when at rest. An increasing aversion to labor and any steady work was noticeable. The heart's action was rapid and irregular, and palpitations and a heavy feeling in the præcordial region were present. Dyspepsia of an extreme nervous type was also present. Acute rosacea was common in these cases. These symptoms constantly grow worse, and are only relieved by large quantities of coffee, generally of the infusion. In some cases the tincture was used. The victims suffer so seriously that they dare not abandon it, for fear of death. Where brandy is taken, only temporary relief follows. The face becomes sallow, and the hands and feet cold; and an expression of dread and agony settles over the countenance, only relieved by using strong doses of coffee. In all these cases, acute inflammations are likely to appear any time. An injury of any part of the body is the starting-point for inflammations of an erysipelatous character. Melancholy and hysteria are present in all cases. Coffee inebriates are more common among the neurasthenics, and are more concealed because the effects of excessive doses of coffee are obscure and largely unknown. Many opium and alcoholic cases have an early history of excessive use of coffee, and are always more degenerate and difficult to treat. A very wide field for future study opens up in this direction.

LETTERS TO THE EDITOR.

*** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Dr. Hann's Studies on Cyclones and Anticyclones.

IN your issue for May 30 I have with much interest noticed a letter by "W. M. D.," entitled "Dr. Hann's Studies on Cyclones and Anticyclones." It contains a passage which I am unable to comprehend; and, with your permission, I should like to ask the writer, through your columns, to enlighten me on the subject.

Mr. D. declares himself an advocate of the convectional theory of cyclones, and states, "There is unquestionably an ascending component of motion in cyclonic areas, and a descending component in anticyclones." This is what I do not understand. The question is apparently that of a body of air moving in a certain direction, but in what direction it is moving I don't quite see; and neither do I understand what is meant by a "component of a motion."

To put my question more precisely, I noticed once, in a book called "Weather," by the Hon. Mr. Abercrombie, that the author had observed that the waves on the North Sea differ in shape, when caused by a north-east wind under high pressure, from that when caused by a south-west wind with low barometer; and he considered this a proof that the air in an anticyclone is a descending current, and the air in a cyclone an ascending current, of air.

As an engineer, I am in the habit of always making a diagram on paper whenever I have a mechanical or dynamical problem before me; and it is a safe rule in applied mechanics that whatever cannot be thus represented does not exist. But in this case I came to the result that a supposed descending current of air in an anticyclone, having once reached the surface of the sea, must needs afterwards follow this surface,—that is, blow horizontally, or come to a standstill,—and also that a supposed ascending current must instantly, the moment it starts, come out of contact with the surface of the sea, and henceforward be unable to materially affect the shape of the waves. In other words, a body of air moving over the surface of the sea must necessarily have a horizontal direction; and the only cause I can imagine of the supposed difference in the shape of the waves is the difference in friction between air and water surface when the air-pressure is high or low.

I therefore beg to ask Mr. D. to give me some kind of a graphical representation showing the direction of the motion of the air in cyclones and anticyclones; say, for example, in the North Atlantic anticyclone at horse latitudes; and if he is unable to do so, he will allow me to believe that his statement is far from being unquestionable.

Mr. D. further states, "The convectional theory is merely a local application of a theory that is universally accepted to account for the general circulation of the atmosphere between equator and poles." But is it, after all, necessary to account for such a circulation? Has there ever been found the faintest actual proof to show that such a general circulation really takes place?

As to the other parts of Mr. D.'s letter, he will excuse me for saying that I cannot share his apprehension that Dr. Hann's studies will much alter the views held on cyclones and anticyclones, as the doctor's observations merely deal with temperatures at the earth's surface, which, as is well known, are local, and perfectly independent of the temperatures of the air at some considerable distance from the surface; which latter, however important in this kind of investigations, are unattainable unless by balloon ascents. A body of surface air moving over the ground must necessarily follow the shape of this latter; and consequently the air which is to-day at the summit of the Alps was yesterday

at the bottom of the Rhone valley, and will to morrow be sweeping over the Rhine, or *vice versa*, according to the direction in which the surface wind blows. Hence Dr. Hann's observations, however valuable otherwise, can have only small bearing on the question of the cause of cyclones and anticyclones.

FRANZ A. VELSCHOW, C.E.

Jones Point, N.Y., June 2.

On the Determination of Parallax by the Spectroscope.

IN the winter of 1883–84 it occurred to the writer that the spectroscope might be made use of in the determination of the parallaxes of certain double stars. As there were no data at hand that would allow a numerical example to be worked out, the method was not published at the time, but was withheld until such data should be available. Recently my attention was drawn to the systematic measures carried on at Greenwich since 1876; and, although these are very unsatisfactory on account of their large probable error, it may be of interest to apply them to an actual parallax determination.

The method about to be proposed is based upon the well known fact that the positions of the lines in a star's spectrum depend not only upon the substances to which these lines are due, but also upon the velocity of the star's motion in the direction of the line of sight. So far as the writer can see, it is applicable only to double stars; and it may be made use of in two different forms, the first of which is applicable when both components of the star are bright enough to be observed spectroscopically, and the second when only one component is bright enough to be so observed.

In the first case, both components being bright, let S be the one to which the orbit is referred, and let C be the companion; ω is the angle that the tangent at C makes with $C\,S$, and θ the angle that it makes with the line of sight. V_0 is the velocity with which S is receding from the earth at a given moment, and V_1 is the velocity with which C is receding at the same moment, both being expressed in miles per second. The orbital velocity of C at this moment we will call v, the unit of length being that length which subtends an angle of one second at the star's distance from the earth. If π is the parallax of the star (supposed unknown), and D is the radius of the earth's orbit, v can be expressed in miles per second by multiplying it by $\frac{D}{\pi}$. Expressing it in this manner, we have

$$(V_0 - V_1) = v \,.\, \frac{D}{\pi} \,.\, \cos\theta \qquad (1)$$

But

$$v = \frac{2\,A}{p\; r\; \sin\omega} \qquad (2)$$

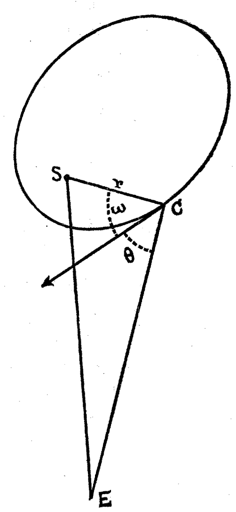
where p is the period of the star in seconds of time, r is the radius vector of the component in seconds of arc, and A is the area of the orbit, the unit of length being the same as in the case of v. Substitution in (1) gives us

$$(V_0 - V_1) = \frac{2\,A\,D\cos\theta}{p\;r\;\sin\omega} \cdot \frac{1}{\pi} \qquad (3)$$

The first member of this equation is to be observed by the spectroscope, and the co-efficient of the second member is to be computed from the elements of the star's orbit. The only quantity remaining is the parallax of the star, which is found by simple division. If it is desired to make a number of observations at different times, and combine the whole by the method of least squares, the normal equation will be, of course, $[a^2]x=[al]$, equation (3) being now of the form $ax=l$.

Undoubtedly the best way to determine the absolute term in equation (3) is to photograph the spectra of both stars on the same plate, and measure the intervals between the corresponding lines in the two. The probable error of a determination so made will be less than if V_0 and V_1 were measured separately and their difference taken. I do not find that this has been done in the case of any star whose orbit is known; but that the lines in the spectrum of a double star can be so photographed and measured, at least in certain cases, is well shown by Professor Pickering's recent work on *Beta Aurigæ* and *Zeta Ursæ Majoris*, which stars were not known to be double until the spectroscope showed them to be so. It is true that the proximity of the components of these stars, and their consequent short periods, make the measurement particularly easy in these cases; yet I trust that it is not unreasonable to hope that measures may be made on other stars sufficiently good to afford us some idea of their parallax.

When one of the components of a double star is so faint that its spectrum cannot be observed, it becomes necessary to modify the foregoing mode of procedure somewhat. Let S be the principal star, as before, and C the companion. Let V be the velocity of recession of the principal star, and V_0 the velocity of recession of the centre of gravity of the system (V_0 being appreciably constant for many centuries). Let a be the semi-axis major of the orbit of the companion, when referred to the principal star, and let a_1 be the semi-axis major of the smaller ellipse described on the heavens by the larger star, in consequence of its having a companion (this



may be determined by comparing the position of the principal star with smaller stars in the vicinity, not physically connected with it). Then we have the equation

$$V = V_0 + \frac{a_1}{a} \,.\, \frac{D}{\pi} \,.\, v \,.\, \cos\theta \qquad (4)$$

(this is obtained by resolving the velocity of the component along the line of sight, multiplying the result by $a_1 \div a$ to find the corresponding differential velocity of the principal star, and adding to the velocity of the centre of gravity of the system). Substituting in (4) the value of v as given in (2), we have

$$V = V_0 + \frac{a_1}{a} \,.\, \frac{2\,A\,D\cos\theta}{p\;r\;\sin\omega} \,.\, \frac{1}{\pi} \qquad (5)$$

This is the form of the observation equation. V is observed, at intervals, by the spectroscope, and corresponding values of the co-efficient of $\frac{1}{\pi}$ are computed. The normal equations are, then,

$$[p\,V] = [p]\,V_0 + [p\,F]\,x\,,$$
$$[p\,F\,V] = [p\,F]\,V_0 + [p\,F^2]\,x,$$

(5) being of the form $V = V_0 + F\,x$.

As already intimated, the writer has applied this method to a particular case, using the spectrum observations made at Greenwich since 1876, together with one measure obtained by Huggins in 1868. Sirius was selected for the purpose for several reasons. Its orbit is fairly well known, the spectrum observations on it cover an interval of twenty years, the period of the star is short, and various determinations of its parallax have already been made by the direct method. The elements of the star, according to Mr. J. E. Gore (*Monthly Notices of the Royal Astronomical Society* for June, 1889), are as follows:—

$T = 1896.47$	$\Omega = 49^\circ\ 59'$ (1880.0)
$P = 58.47$	$i = 55^\circ\ 23'$
$a = 8''.58$	$\gamma = 216^\circ\ 18'$
$e = 0.4055$	$\mu = -6^\circ.157$

It appears also, from Auwers's work, that the semi-axis major of the orbit that the principal star describes about the centre of